
Three Big Cs

Climate, Cement and China*

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Cement is a low-cost construction material whose manufacture generates significant carbon dioxide emissions. As these emissions enter a carbon-constrained world, they may ultimately have a significant impact on the industry's financial performance. Consequently, the cement industry is developing a response to climate change management and the connected political process. Ten of the world's leading cement-producing corporations, representing more than one-third of global cement production, published a joint *Agenda for Action* in 2002 to address sustainability issues for the industry, including climate change. Other issues identified are emissions reduction, use of fuels and raw materials, employee health and safety, local impacts on land and communities, and internal business processes. Examining the rationale for, and the effects of, proactive climate initiatives in the cement sector, this paper elaborates on the conditions for the spread of cement-related climate action to China, where more than one-third of global cement production occurs, 80% of which involves inefficient kilns using outdated, highly polluting technology.

- Cement
- China
- Climate change
- Coalition-building
- Commitment
- Development
- Europe
- Management
- Sustainability
- Technology

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IN 2000, THE CEMENT SUSTAINABILITY INITIATIVE WAS LAUNCHED, INVOLVING ten corporations that together produce one-third of all the world's cement. Under the watchword of 'Toward a sustainable cement industry', and co-ordinated by the World Business Council for Sustainable Development (WBCSD), the initiative resulted, in July 2002, in the publication of an *Agenda for Action* (WBCSD 2002b), signed by the business leaders of all the participating companies. Through this agenda, a first five-year action plan has been drafted to define short-term ambitions, as well as necessary partnerships for joint and individual actions identified in the process. Climate protection constitutes a core component of the Agenda.

This paper relays insights and experiences learned so far from these combined efforts. It aims to show and discuss the rationale for, and consequences of, this proactive initiative based on the perspectives of both the programme manager and a participating party, namely the French transnational building materials group Lafarge. Another objective is to elaborate on what possible effects the initiative may or may not have on Chinese cement production, hitherto structurally and technically separated from the otherwise largely internationalised stage of actors, yet supplying more than one-third of global cement. As the Cement Sustainability Initiative continues into its subsequent phases, it offers an expanded perspective on the role of corporate environmental responsibility and stewardship, and cement production in China could become an appropriate stage for studies and analyses of theories about industrial sustainability and development in the developing world.

The cement industry

Cement is the basic constituent of concrete, used in the construction of buildings, roads and other types of infrastructure all over the world. The principal raw material for the manufacture of cement is limestone, which, crushed and ground, is fed through a kiln to produce an intermediate material called clinker. Clinker production is an energy-intensive process, which requires extremely high temperatures, typically between 1,200 and 1,600°C inside the kiln. After the clinker is cooled, it is mixed with various proportions of additives, such as gypsum, to make cement.

The predominant use of fossil fuels in cement-making contributes to emissions of considerable quantities of carbon dioxide. But this is less than half the story. Emissions from fuel combustion typically amount to only 40–50% of total carbon emissions from cement production. In addition, large amounts of carbon dioxide are released from the raw material itself, in a process called calcination, making the sector the largest, non-energy source of anthropogenic greenhouse gas emissions. According to Marland *et al.* (2001), calcination of limestone in cement kilns produced, in 1998, worldwide emissions exceeding 200 million tonnes of carbon, or, in total, 760 million tonnes of carbon dioxide (cf. Hendriks *et al.* 1999). This corresponds to over 3% of the emissions from global burning of fossil fuels. Table 1 shows, for comparison, the world's top ten carbon dioxide-emitting countries in 1998.

In relation to the cost of production, transportation of cement is expensive and quickly becomes uneconomical as distance increases. The competitive range for road transport is roughly 200 km, and about double for rail. Therefore, exports and imports of cement or clinker are limited compared with local or domestic production. Freight by ship is the only way to transport cement over large distances profitably. As a consequence, production of cement is spread out across the globe to serve local markets. Even so, there is a clear consolidation trend among actors, and a circle of transnational groups now dominates large parts of the sector. Table 2 shows the sales volumes and world market shares of the five largest cement corporations in 2001.

	C (million tonnes)	CO ₂ (million tonnes)
World total	6,610	24,200
United States	1,490	5,450
China	848	3,110
Russia	392	1,440
Japan	309	1,130
India	290	1,060
Germany	225	826
United Kingdom	148	543
Canada	128	468
Italy	113	415
Mexico	102	374

Table 1 WORLD'S TOP TEN COUNTRIES BY 1998 TOTAL CO₂ EMISSIONS, INCLUDING FOSSIL-FUEL BURNING, CEMENT PRODUCTION AND GAS FLARING

Source: Marland et al. 2001

	World total	Lafarge	Holcim	Cemex	Heidelberg	Italcementi
Volume (million tonnes)	1,700	88	84	61	47	42
Share (%)	100	5.2	4.9	3.6	2.8	2.5

Table 2 CEMENT SALES VOLUMES AND WORLD MARKET SHARES OF THE WORLD'S TOP FIVE CEMENT-PRODUCING CORPORATIONS

Source: Lafarge estimates for 2001

Proactive responses to climate change

The high carbon intensity of the industry provides international cement producers with a strong rationale for proactive responses to climate change. The implications for industry of the commitments by the governments of countries in Annex B to the Kyoto Protocol remain to be seen, but policies and regulations are to be expected that penalise heavy emitters and that benefit those who perform better. Moreover, and regardless of present controversies and debates about the Protocol itself, the awareness of carbon constraint has entered the worlds of both politics and business (Stigson 2001). New opportunities to increase markets and intangible assets, as well as to avoid costs, emerge for actors who can adapt. Such reasoning supports first-mover strategies and proactivity, especially—in the short term—among actors who have a large stake in markets in Annex B countries that claim to adhere to their Kyoto commitments. In their *Agenda for Action*, the participants of the Cement Sustainability Initiative state: 'We have chosen to adopt an agenda for sustainable development for three reasons: to prepare ourselves for a more sustainable future; to meet the expectations of stakeholders; and to individually identify and capitalize on new market opportunities' (WBCSD 2002b; cf. WBCSD 2002a; Sprigg and Klee 2002).

The Cement Sustainability Initiative

In 1999, three of the largest cement groups—Cimpor, Holcim and Lafarge—approached WBCSD, requesting assistance in organising a structured evaluation of the important issues facing the industry in terms of sustainable development. From this request, the Cement Sustainability Initiative grew and was launched in February 2000, by which time the group of producer participants had come to encompass the following ten corporations, together forming the so-called Working Group Cement:

- ▶ Cemex, Mexico
- ▶ Cimpor, Portugal
- ▶ Heidelberg Cement, Germany
- ▶ Holcim, Switzerland
- ▶ Italcementi, Italy
- ▶ Lafarge, France
- ▶ RMC, United Kingdom
- ▶ Siam Cement, Thailand
- ▶ Taiheiyo Cement, Japan
- ▶ Votorantim, Brazil

Alongside the Working Group, key parties to the Initiative include a sponsoring group to provide intellectual and funding support, a lead consultant to organise research and produce reports, an objectively reviewing assurance group, and, not least, the WBCSD Secretariat serving as programme manager.

During the two years following the launch of the Initiative, seven Stakeholder Dialogues were arranged (in Brazil, Thailand, Portugal, Egypt, USA, Belgium and China) and 13 sub-study reports were published, resulting, in March 2002, in a concluding report (Battelle 2002). The *Agenda for Action*, published a few months later, represents the response of the Working Group members to this report.

In the concluding report, eight key issues for the industry are presented against the background of the so-called triple bottom line of sustainable development, which comprises economic prosperity, environmental stewardship and social responsibility. The eight issues identified and selected as a result of the work presented in the sub-studies are resource productivity, climate protection, emissions reduction, ecological stewardship, employee wellbeing, community wellbeing, regional development and shareholder value. The issue of climate protection is specifically elaborated on in sub-study 8 (Humphreys and Mahasanen 2002). Here, potential actions are suggested for the sector to improve its performance in the short as well as the medium and long term, involving several types of actors including the industry, authorities and non-governmental organisations. Technically, and applying presently conventional carbon dioxide management approaches, specific carbon dioxide reductions (in tonnes CO₂ per tonne product) of approximately 30% by 2020 (compared with aggregated levels in 1990) are assumed possible in a global context. Primarily, these approaches consist of improved plant efficiency, expanded use of composite cements, and fuel switching including the increased use of alternative fuels and resources. As country-specific conditions vary considerably, opportunities and requirements to reduce emissions will also vary among regions and individual companies. Assuming that plant-level energy efficiencies increase annually by 0.5–2% (depending on region), the contribution of such measures to the worldwide specific carbon dioxide emissions reduction potential is 11%. Achieving this, however,

is dependent on dedicated and successful energy-efficiency initiatives being carried out in countries where the sector today is relatively inefficient, such as the United States and China. Reaching the 30% reduction requires a whole portfolio of actions pursued simultaneously and aggressively across the globe (Humphreys and Mahasenan 2002).

Based on the above key issues, the concluding report presents benefits of progress, and the current sustainability status of the industry. It also suggests a vision for the future, as well as goals and key performance indicators, and derives a set of ten recommendations for the industry. The second recommendation addresses climate change, calling for the establishment of corporate carbon management programmes, statements of medium-term carbon dioxide reduction targets, both company-specific and industry-wide, and the initiation of long-term processes within areas such as product innovation.

In response to all of these proposals, the *Agenda for Action* highlights six priority areas, within which collaborative and individual actions will be focused during the subsequent and implementing phases of the Initiative:

- ▶ Climate protection
- ▶ Fuels and raw materials
- ▶ Employee health and safety
- ▶ Emissions reduction
- ▶ Local impacts
- ▶ Internal business process

Why, then, has the industry undertaken this effort over several years, costing approximately US\$4 million so far? To understand this, it is important to see how sustainable development issues match those of the cement industry. Figure 1 illustrates how the triple bottom line of sustainable development coincides with current industry concerns.

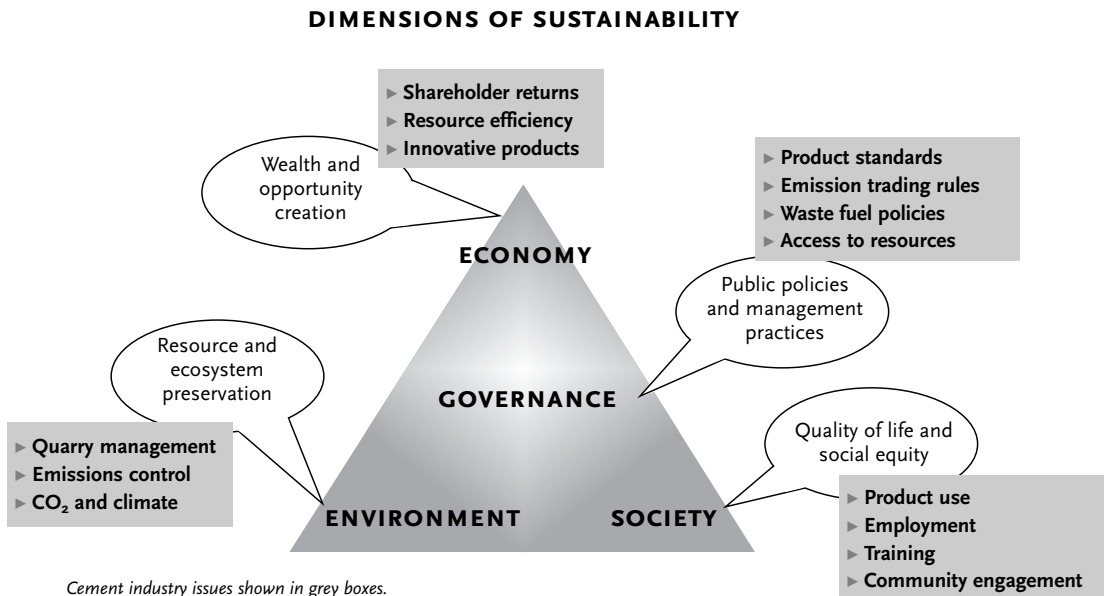


Figure 1 CONFLUENCE BETWEEN SUSTAINABLE DEVELOPMENT GOALS AND IMPORTANT PRIORITIES FOR THE CEMENT INDUSTRY

Source: World Business Council for Sustainable Development

In short, sustainable development provides the industry with a comprehensive framework for tackling some of the biggest issues it faces today, including climate change, and, therefore, the industry's business leaders believe it is central to their progress towards creating effective and efficient businesses in the 21st century.

Applying this view to the specific issue of climate protection highlights the value of a comprehensive standpoint. From a financial perspective, one might currently estimate carbon costs as US\$5–25 per tonne of CO₂. These values may equal or exceed the average margin of today's cement producer. Reducing carbon dioxide emissions will require a variety of strategies including energy-efficiency improvements and using different fuels and raw materials in the cement manufacturing process. Yet some of these substitutions remain controversial, indicating an urgent need for better understanding and communications with stakeholders (including employees) about the risks, benefits and management of these alternative materials.

One early output from the Cement Sustainability Initiative has been a Carbon Dioxide Accounting Protocol to provide a common framework for monitoring and reporting carbon dioxide emissions (Vanderborght and Brodmann 2001). The framework, developed in consultation with the World Resources Institute and the WBCSD, now provides an agreed and well-accepted methodology for dealing with carbon dioxide in this industry—an essential first step before trading and other market mechanisms might be used successfully. It is also an essential first step for any company to understand both the quantities and costs of their carbon dioxide emissions.

Lafarge Corporation

Founded in France in 1833, Lafarge is now a world-leading transnational corporation within the construction materials industry, with a presence in 75 countries across the world (Lafarge 2001). Since 1999 its operation is organised into four autonomous divisions, of which cement is the dominant. Through several mergers and acquisitions, the latest being the acquisition of the British manufacturer Blue Circle in 2001, Lafarge's cement division has become the world's largest cement producer with around 160 production sites, and a total production in 2001 of close to 90 million tonnes. A large share of this production is located in developing countries.

Lafarge prides itself of its management strategy—the 'Lafarge Way'—based on a model of participatory and social, human-oriented management. Not only the group's own employees but a wide array of external stakeholders are included in the scope of its efforts in this area. As a result, this corporate tradition has evolved and been developed over the decades to include a high level of awareness of, and a proactive approach towards, environmental issues. A measure of the importance attributed to such issues by Lafarge in later years is given by the corporation's participation as co-founder of several initiatives: the WBCSD (1991), the French association *Enterprises pour l'Environnement* (1992) and, most recently, as the first major industrial participant in WWF's Conservation Partnership Programme (2000).

Admittedly a troublesome concern for a cement manufacturer, climate-change mitigation is recognised by Lafarge as having both environmental and strategic business importance. Hence, within the framework of its partnership with WWF, the group has taken a clear and proactive approach, declaring its preparedness to shoulder its climate responsibility by making a unilateral commitment. In November 2001, Lafarge announced its intention to decrease its absolute carbon dioxide emissions in industrialised countries by 10% from 1990 to 2010.¹ This initiative might be compared with the Kyoto

¹ Lafarge, who in their own calculations include displacement of fossil fuels through substitution by waste-derived fuels, state a total carbon dioxide reduction commitment of 15%. According to WWF's more conservative method of carbon accounting, however, this corresponds to a reduction of 10%.

commitment of the European Union to reduce its greenhouse gas emissions by 8%. In addition to this first target, which is related to but not dependent on production volume, Lafarge also makes a more general commitment of decreasing globally by 20% from 1990 to 2010 its specific carbon dioxide emissions (in kg CO₂ per tonne cement).

Three principal strategies are brought forward as means through which to fulfil these reduction objectives:

- ▶ Energy efficiency
- ▶ Energy substitution
- ▶ Materials substitution

Where applicable, greater energy efficiency may be realised through investments in technical upgrades or process changes to reduce losses of heat and calcined particulate matter. Energy substitution, meaning a switch to less carbon-rich fuels than the presently predominant coal and petroleum coke, may reduce greenhouse gas emissions by considerable amounts. In particular, Lafarge considers waste-derived alternative fuels as an interesting option, whereas natural gas and renewable energy such as biomass are less attractive from a cost perspective. Due to the intense heat in a cement kiln, it is quite suitable for waste incineration of, for example, used engine oils, solvents and tyres, a process for which there is an increasing need, not least in Europe, where stricter regulations on waste disposal are being introduced. Since such incineration would reduce overall consumption of primary fossil fuels, Lafarge, in its own book-keeping, considers it to be carbon dioxide-neutral. On this point, opinions differ between the company and its partner WWF.² Also, the use of waste as an alternative fuel source can be problematic as it may worry local stakeholders, causing emotional debates (cf. WBCSD 2002a; Sprigg and Klee 2002). Materials substitution, finally, involves making use of cementitious properties found mainly in by-products of other industries, thereby partially replacing the clinker used in cement. Blast-furnace slag from steel production and fly ash from coal-fired power generation are two well-known and established examples of such by-products. Reducing the need to produce clinker obviously reduces carbon dioxide emissions.

Outcome

The Cement Sustainability Initiative has provided a rich set of reference materials about the cement industry and sustainable development. More than 1,500 pages of research reports were developed during the study phase. Between March 2002 when the results were released, and October 2002, more than 100,000 documents were downloaded from the project website, indicating quite a remarkable interest in such a specialised topic in an industry with a very low public profile.

More importantly, the Initiative has provided a possible model of changing industrial performance by following a process of independent expert research, extensive stakeholder consultation, co-operative industry planning and peer review of the entire process. It is noteworthy both for its magnitude and its timing in the absence of crisis 'firefighting' or industry failure. Moreover, the risks of being a single first-mover have been handled by adopting a united front, although a line has also had to be drawn between co-operation and competition. This aspect is evident in the *Agenda for Action*, the first comprehensive, voluntary plan in the cement sector to address real industry needs: commitments for each of the six priority areas presented are split into joint and

² See footnote 1.

individual actions to be taken over an extended time-frame. These actions include developing sets of good-practice guidelines in several areas, agreeing on common standards for measurement and public reporting of performance, improving stakeholder engagement, and communicating publicly about progress. Of course, the real proof of a successful approach will be in the results achieved, not in the plans made, and it is still too early to assess results. The formal publication of the action plan and time-line took place in July 2002.

The members of the Working Group Cement only form part, albeit a substantial one, of the global cement sector. In order to really live up to their motto of 'making a difference', a wider stance is necessary, and therefore the Sustainability Initiative is designed to be inclusive. Creation of enterprise value, importance of stakeholders and developing-country concerns are topics that have been brought forward. Not least from such perspectives will the longer-term outcome of this initiative be interesting to monitor (cf. Nicholls 2002).

As a commodity, cement is mostly limited to regional markets, but as actors, cement producers operate globally. Therefore, it can be argued that this sector offers a particularly suitable stage for observations of the effects of proactive, industrial sustainability strategies. In some trade theories, concepts such as *pollution havens* and *race for the bottom* imply that mechanisms exist that compel authorities (not least in developing countries) to use lax environmental standards for industry as a means of encouraging foreign investment and relocation of industry (Rauscher 1999). The real effects of such mechanisms are disputed, but cannot be expected to interfere with cement production, which will not move easily from local markets. Instead, and as a consequence, the sector presents an opportunity for investigations of the conditions for, and possible effects of, a converse relation: the *pollution halo*. Through this mechanism, it is assumed that sound environmental practices may spread among local actors, producers as well as authorities, once forerunners demonstrate the potentials for new corporate values to create business advantages (OECD 2002: 584).

Though there may be no immediate crisis for the international cement industry, it is clear that the climate issue poses real, potential risks for the future, including risks of business impediments. The ongoing political and scientific processes of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol make this evident. It is not explicitly stated in the documentation of the Initiative; still it is not misleading to point out these factors as driving forces for many Working Group members to participate. Not surprisingly, the corporations with large markets in Europe have been among the most active within the Initiative.

Bystanders

Not all cement companies participated in the Sustainability Initiative. The research phase involved substantial contributions of both time and funds, and many companies lack the resource base to make these contributions. This is not surprising. After all, the initiative is one of leadership, through which major and leading companies are trying to set a long-range programme in place. Not everyone can nor wants to be a leader, but, in its effort to be inclusive, the Initiative is making all its results publicly available and promoting them via consultation with trade associations and others, hoping that other companies will adopt parts of the programme that suit their circumstances and capabilities. That way, they will not have to spend their resources developing other approaches or solutions. It is encouraging to note that several other cement companies are expressing interest in joining the Initiative, including Uniland from Spain, Secil from Portugal, Titan from Greece, and several others.

Developing countries

Within the Cement Sustainability Initiative, three corporate members are based in developing countries (Cemex, Siam and Votorantim), and others, like Lafarge, have substantial business interests in the developing world, where opportunities for growth and expansion still are significant. Issues of particular importance to developing countries are naturally brought forward within the Initiative.

Perhaps even more acutely than in other parts of the world, the triple bottom line of sustainability, as a whole, represents a pressing challenge for authorities as well as for business in developing countries. Economic prosperity and socially secure living conditions are urgent needs for people in poverty-stricken areas. When the pursuit for development occurs at the expense of environmental stewardship, however, serious problems that are detrimental to sustained improvements in economy and welfare alike will ensue in the longer run. Common barriers to balanced development in developing countries are lack of capital and capacity, and inefficient governance. Through their expressed commitment to the triple bottom line, as well as through their stakes and interest in developing countries, the Initiative members might contribute, in line with theories such as the pollution halo hypothesis, in lowering somewhat the thresholds of such barriers.

Meant to reinforce and strengthen this kind of incentive in business, the Kyoto Protocol provides industry with the so-called Clean Development Mechanism (CDM). The CDM allows for the generation of Certified Emission Reductions (CERs) when a project, undertaken in a non-Annex B country, results in reductions of greenhouse gas emissions compared with a baseline scenario in the absence of that same project. After being issued, the CERs may be traded and used in countries that need them to stay in compliance with their commitments to limit emissions, as stated in Annex B to the Protocol. Many details remain to be settled before CDM projects can get under way, and there is justified uncertainty about how effective they may be in reducing greenhouse gas emissions and promoting sustainable business initiatives in the developing world. Still, the evident and considerable potential for emissions reduction that exists in developing countries today is reason enough for transnational cement corporations to expressly state their serious interest in future CDM projects. Technical facilities, know-how and equipment, as well as developed practices and transparency in management, may spread through business investments and lead to real improvements within the global cement sector. Although uncertainty remains about the mechanism as such, the CDM framework currently represents an additional spur for cement corporations to consider such investments for the future.

For the cement industry, China is a particularly important developing country, interesting from a CDM perspective and also because of the sheer size of its market. From a sustainability point of view, great opportunities for improvement exist. The next few sections expand on this topic.

China's cement sector

Since China began its economic reform policy in 1978, Chinese cement production has increased more than sevenfold. Today, around 600 million tonnes of cement are produced every year in China alone, representing more than one-third of global cement production. Figure 2 illustrates the magnitude of China's cement sector in 1998 compared with the aggregated shares of the 12 next-largest cement-producing countries.

Chinese cement production attracts attention not only because of its volume. The unusual structural and technical profiles of China's cement industry are also a charac-

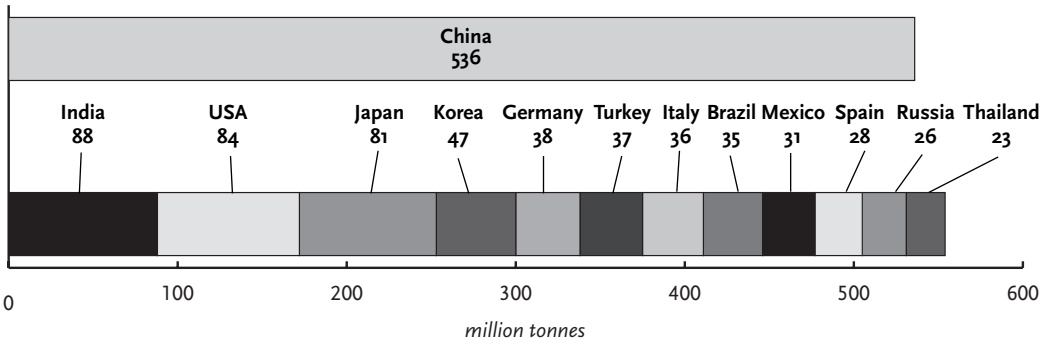


Figure 2 CEMENT PRODUCTION BY COUNTRY IN 1998 (THE FIGURE FOR SPAIN REFERS TO 1997): CHINA COMPARED WITH THE AGGREGATED PRODUCTION OF THE 12 NEXT-LARGEST CEMENT-PRODUCING COUNTRIES

Source: UN 2001

teristic feature. In contrast to the large-scale plants, in terms of production capacity, and the high degree of corporate consolidation that are seen elsewhere, enterprises in China are generally very small, as well as scattered both geographically and in terms of ownership. And, whereas rotating cement kilns dominate internationally, Chinese output is mainly generated in vertical-shaft kilns, which are rare in most other parts of the world.

Prior to market reforms, regional self-sufficiency was highly promoted in China, both in agricultural and industrial production. A tradition of small-scale, rural industrialism was established. In the 1980s and 1990s, soaring demand for cement led to massive but unco-ordinated investment in new production capacity in rural areas. Thousands of so-called township and village enterprises, or TVEs, emerged. Owned collectively and by local authorities at different levels, or even privately, installations were typically low-technology, labour-intensive shaft-kiln plants, needing far less capital for upfront investments than do modern, automated plants using rotary kilns with pre-heaters and pre-calciners. As a result, close to 80% of all cement in China is now produced by small enterprises, often suffering severely from inefficient use of energy and other resources, problems with high variability in output quality, and high pollution levels. Dust emissions, in particular, constitute a major threat to the local environment, and energy inefficiency contributes to unnecessarily excessive emissions of carbon dioxide from fossil coal.

Authorities and the industry acknowledge most of these problems, and measures are being taken to overcome them. China’s influential State Economic and Trade Commission has blacklisted old and outdated technology, and modern production methods are promoted. A domestic consolidation trend can be observed and is being encouraged. Dust emissions, resource inefficiency, deficient product quality, and the plethora of technically and financially inadequate producers are targeted weaknesses within the sector. The climate change issue, despite apparent connectedness and the potential opportunities at hand, does not usually enter into this equation at all when considered by domestic actors (Nordqvist and Nilsson 2001).

The Sustainability Initiative in China

Because of its size, as well as its need for structural reform, the Chinese cement market is a stage with great expansion potential for the transnational actors of the Sustainability Initiative. Several of the corporations in the Working Group already operate in China. So far, however, their activities within this huge market remain marginal. A brief overview of important actors in Chinese cement production is presented in *ZKG International* (2002). Among the most involved and most active foreign companies is Lafarge, which currently operates two joint-venture cement production facilities in the country: Chinefarge near Beijing (since 1994), and Dujiangyan near Chengdu in the south-central province of Sichuan (commissioned in 2002). Both plants represent illustrative cases of improvements in sustainability performance compared with prevalent conditions in the sector. Heidelberg, Holcim and Taiheiyu have also established themselves within China. The importance placed by the Cement Sustainability Initiative on China is evident and demonstrated not only through the fact that the concluding workshop in a series of Stakeholder Dialogues was held in Beijing in December 2001. In addition, complementing the series of thirteen sub-study reports, a special regional study was conducted to highlight conditions specifically in China (Soule *et al.* 2002).

Although the Chinese authorities claim to welcome foreign investment, there are many obstacles that impede participation in the market by foreign-owned actors, and hence their possible halo effect as well. Clashes in management cultures and the importance of strong goodwill relations, so-called *guanxi*, with local authorities are part of the explanation. National and local protectionism also play a role. There are, nevertheless, encouraging signs that, in some parts of administration, issues pertaining to sustainability are gaining recognition. For example, the China Council for International Co-operation on Environment and Development, an advisory group to China's State Council, is addressing a number of such issues. Composed equally of senior Chinese and foreign experts, the China Council has recently set up a task force for industry and sustainability, co-chaired by Björn Stigson, President of the WBCSD.

Rings on the water?

At central government levels, local pollution is recognised as a major industrial problem for China, and efforts are being directed at curbing it. Also, transboundary and global environmental problems are acknowledged. For local authorities, the overriding development goals, however, are increasing volumes and short-term economic growth. In the current study case, the cement industry, less money is spent on pollution abatement than in other industrial sectors in China (Soule *et al.* 2002: 26). One important environmental concern that is widely recognised by all sector actors, however, is particulate emissions. Since the late 1990s, the cement industry has been responsible for more than 40% of all industrial particulate emissions in China. As a consequence, other pollutants receive little or no attention. In particular, carbon dioxide is a non-issue. Awareness about greenhouse gases, and about the possible implications of China's active participation in the UNFCCC, is very low within the industry.

In wording and intention, China's regulations and laws for environmental protection in industry are strict, but their application is weak, which means that, in effect, the regulatory framework is lax. At the same time, a general condition for foreign companies to be allowed to operate in China is their willingness and ability to comply with existing regulations, which tend to be emphasised more with new and foreign parties than with established enterprises. In themselves, these regulations are not a barrier to foreign investment in cement production. International actors usually operate under even stricter regulations than the Chinese ones. A problem in China, however, is the incon-

sistency with which such regulations are enforced. Although China's cement market is huge, profitability is almost non-existent as the market overflows with cheap, low-grade cement. Moreover, local protectionism and *guanxi* generally favour domestic actors over foreign ones. Still, foreign investment in cement production is increasing, but from an extremely low level.

Currently, the possible opportunities for CDM projects contribute to fuelling the interest of foreign actors in making further investments but, within China, such lines of thinking do not create much of a response. There are several reasons for this. The most immediate one may be lack of awareness within the Chinese cement sector about the climate issue. Carbon dioxide, although a major pollutant from the industry, is simply not recognised as a problem. Dust remains the overshadowing concern. Therefore, local actors, even if they are aware of the mechanism, do not appreciate it as an opportunity to attract investment. On a political level, the dominant attitude in China towards the CDM has been one of scepticism so far. There are concerns that it would provide a means for Annex B interests to exploit the situation in developing countries, thereby allowing them to avoid taking action at home. Of late, however, a shift in official positions towards a more open stance can be discerned. Within the important State Development and Planning Commission, for example, arguments in favour of China hosting CDM projects are brought out. Still, opposing views or lack of awareness remain dominant in many parts of the complex Chinese structure of administrative bureaucracy, as well as in business. Therefore, though hoping for a constructive mechanism to be put into place eventually, potential CDM investors see many uncertainties that need to be sorted out before anything can actually happen. The question of ownership of CERS produced in China is one such concern being voiced, to which, at present, there is no answer.

Against this background the prospects, at present, for the spread of cement-related climate action within China may seem bleak. Still, it is not unfeasible to think that domestic actors, if recognition increases of climate as a concern in industry, can pick up speed and adopt appropriate action using the momentum already gained within the Cement Sustainability Initiative. Further studies and evaluations in and around this field may contribute to better-informed policy decisions, by administrative as well as corporate actors, in order to encourage such a development. They may also contribute to the building of a broader base for academic theories on technology diffusion, trade and corporate behaviour in transitional and developing countries.

Summary and conclusions

A group of progressive and heavyweight actors within global cement production has set out to 'make a difference' in a move toward a more sustainable cement industry. This move entails efforts in scrutinising and adjusting their own activities, individually and in co-operation with each other, as well as with stakeholders in local communities and with authorities. Such aspects are important not least in developing countries, where the potential for really making a difference is considerable, and where, due to infrastructural and construction needs, there is still room for significant market growth. The largest and fastest-growing market is China, but it is isolated and only beginning to be penetrated by international influences. Whether and how the momentum for sustainability can be picked up by Chinese enterprises and policy-makers in the ongoing and fundamental, sectoral restructuring process for domestic cement production are important questions for future study.

The argument is sometimes heard that concerns about sustainable performance by industry are a luxury afforded only in developed countries, and that corporate actors in the developing world, due to weak protective regulation by governments, are compelled by market mechanisms to neglect their moral responsibilities by overexploiting labour, resources and the environment alike. The members of the Cement Sustainability Initiative, however, argue that creation of enterprise value must include social concerns and environmental stewardship. Through their *Agenda for Action*, therefore, these ten cement corporations have formalised a framework in order to realise their visions for the future: that cement companies integrate sustainable development into their global operations, and that they be known as leaders in industrial ecology and innovators in carbon dioxide management. Furthermore, they shall be regarded as attractive employers, and have established relationships of trust with the communities in which they operate (WBCSD 2002b).

The cement industry differs from many other industries in that the product generally cannot profitably be transported over large distances. Therefore, production has to be located in close proximity to the market, which means that for cement producers the notion of pollution havens does not apply. Instead, the Cement Sustainability Initiative offers an opportunity to examine the possibility of a detectable pollution halo effect, not least within the restructuring process presently under way in Chinese cement production.

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